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PATENTS ACT 1977

and

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Way, Gerrards Cross, Buckinghamshire, England, hereby declare  
that I am conversant with the German and English languages and  
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No. 0,230,994

in the name of Siemens Nixdorf Informationssysteme  
Aktiengesellschaft

Signed this 25th day of May 1993



D. E. LIGHT

For and on behalf of RWS Translations Ltd.

The invention relates to a method according to the preamble of Patent Claim 1. A method of this type is known from EP-A-0 067 303.

5 In commerce and administration, data processing systems are used with primarily two application principles. On the one hand they are used to accomplish commercial tasks such as invoicing, writing delivery notes, updating general ledgers, calculating net requirements and payroll accounting for example. Such commercial  
10 tasks are accomplished, with data being processed thereby, without reference to the respective office organisation. On the other hand, a data processing system can also be used as an office communications system to increase the efficiency of purely administrative tasks.  
15 This chiefly involves the processing of forms, the contents of which are not processed further by the data processing system. In addition, other areas of office organisation, such as diaries, files, card files, addresses etc. for example, are incorporated. This thus  
20 primarily involves the representation of data.

It is now desired to combine said two application principles of a data processing system, that is to say to process data in a word processing program and represent them in a text. An office worker for textual tasks who is  
25 unfamiliar with programming is to be capable of creating a form with integrated data processing in this case.

EP-A1-0 067 303 discloses already one possibility for integrating the abovementioned two application principles of a data processing system which is not based  
30 on technical programming measures.

For this purpose, five commands with a simple structure are provided to describe data groups and their spatial arrangement on the form. In addition, a summing command is also provided, with the aid of which the  
35 aforesaid data groups can be added.

The simple summation of selected individual items is not, however, sufficient for the accomplishment of commercial tasks. As already mentioned, invoices and delivery notes are also to be generated, accounts updated

and payroll calculations performed. However, for this, for example, serial numbers must be formed, or calendar data processed, checksums calculated and algebraic calculations performed in addition to the summation.  
5 Prices must be multiplied by specified quantities and percentages must be calculated in the forms to be processed.

The object of the invention is to state a method with which different types of data can be linked with one  
10 another according to different processing rules and in any order.

This object is achieved by the features of Patent Claim 1. Advantageous further developments are stated in the subclaims.

15 Within the meaning of the invention, field-typical data processing with an individual program denotes the assignment of specific processing programs to specific field types of a form. In form processing there are forms and form fields of different types, from which  
20 a selection can be made. Different form types are, for example, delivery notes, invoices, salary accounts etc. Different field types are defined by the fact that they serve the same purpose over and over again, or are provided to represent identical types of information.  
25 These are fields in which, for example, an address, a customer number, a date, a quantity, a designation or a price are specified.

The individual programs for a specific field type permit data processing specifically for this field type,  
30 taking into account the identical operations that are required here and recur over and over again. Fields that merely specify serial numbers require a simple addition program, while date fields that display a calendar date for example are subjected to data processing dependent on  
35 the nature of the calendar.

If, then, the form specification is to be used not only to indicate the type of form selected, but also to specify the construction of the form processing program from field-typical individual programs, then this

permits the form-specific data processing of form contents, while still being independent of the other application program of a data processing system. Integration of data processing and data representation is realised in this way, in which the data representation and the associated data processing can be varied without laborious revisions of an entire application program being required.

The step-by-step construction of the form processing program from field-typical individual programs can be performed according to different guidelines. Thus, for example, it is possible to design the specification of the construction by the form specification in such a way that, for the selection of a form specification, the user of the data processing system is free to select the represented fields of the form he wishes to process. This means an optionally selectable order of processing for a form processing program, which is constructed by the user from field-typical individual programs during its execution. It is however also possible to utilise the identification of the form specification for indicating the field designations contained therein directly for controlling the order of calling up the individual programs. In any case, the identification result of the form specification is used to access stored data that are assigned to the respective identified field and require processing.

Exemplary embodiments of the invention are described below with reference to the figures, in which:

Fig. 1 shows the most important components of a data processing system for data processing and data representation,

Fig. 2 shows a second data processing system with special components for form processing, and

Fig. 3 shows a diagrammatic representation of one or more form pages.

The data processing system shown in Fig. 1 permits communication between its individual functional units via an internal bus 10 and an external bus 11,

which are indicated by broken lines in the figure. Connected to the external bus 11 via a display memory 13 is a display workstation 12. Signal paths 14 and 15 are provided for this purpose. Also connected to the external  
5 bus 11 via a signal path 16 is an external storage means 17, which may be a disk store or the like for example.

A signal path 18 leads from the external bus 11 to a write controller 19, which is connected via a further signal path 20 to the internal bus 10. Further-  
10 more, a read controller 21 is provided, which is connected via a signal path 22 to the external bus 11 and via a signal path 23 to the internal bus 10. The read controller 21 is furthermore connected via a signal path 24 to a scanning and interpretation unit 25.

15 Two internal memories 26 and 28 are provided, of which the internal memory 26 functions as program memory and is connected via a signal path 27 to the internal bus 10, while the internal memory 28 functions as data memory and is connected via a signal path 29 to the internal bus  
20 10.

The steps with which the program execution can be controlled in such a way that the information contained in the individual fields of a form can also be processed within the data processing system, that is to say can be  
25 removed from a form and altered, or subjected to data processing steps, will now be described in general below.

First of all, a data word is input as form specification into the display memory 13 via the keyboard of the display workstation 12 via the signal path 14,  
30 with which data word a particular desired form is to be selected from a given set of forms. The contents of said data word are then transferred from the display memory 13 via the signal paths 15 and 22 to the read control circuit 21, with which the scanning and interpretation  
35 circuit 25 is addressed via the signal path 24. The contents of the data word are scanned and interpreted, so that the specification of the desired form can be detected thereby. Said specification is transferred via the read control circuit 21 and the signal paths 22 and

16 to the external storage means 17 which contains the set of forms available for this data processing system. The desired form is addressed in the external storage means 17, whereupon information, in the form of data words, about the structure and contents of said addressed form is written by the external storage means 17 into the display memory 13 via the signal paths 16 and 15 under the control of the write control circuit 19. The desired form is then represented as a form mask on the display workstation 12 in this manner via the signal path 14.

This operation is linked to the transfer of data words from the display memory 13 into the data memory 28 under the control of the write control circuit 19. Said data words identify the field specifications of the individual fields of the form represented on the display workstation 12. The data words are thus transferred via the signal paths 15, 18, 20 and 29 into the data memory 28. If the data memory 28 contains said data words of the field specifications, it can transfer them under the control of the read control circuit 21 via the signal paths 29, 23 and 24 to the scanning and interpretation circuit 25, which sequentially evaluates the data words in order to determine the individual program required for each field of the form represented on the display workstation 12, with which individual program the information represented in said field can be accessed and can undergo data processing. The individual programs are addressed in the external storage means 17 via the signal paths 22 and 16 by means of the read control circuit 21, and are written into the program memory 26 via the signal paths 23 and 27, so that step-by-step said program memory receives a sequence of individual programs, which can then be executed like a normal program.

Said program sequence is dependent on the division of the form represented on the display workstation 12 in each case into individual form fields and on the sequence of addressing the individual form fields, which is determined by the user at the display workstation 12 or by the form specification.



During the execution of the program logic constructed in this way in the program memory 26, as with any normal data processing, it is possible for the user to be prompted, the user to react, and internal data processing to be performed. Once this has been carried out for one field of the form mask represented on the display workstation 12 in each case, such data processing can be repeated as often as desired for the respective form, in each case the data words for the respective field being transferred from the form specification to the scanning and interpretation circuit 25, and a sequence of field-related program steps being transferred from the external storage means 17 into the internal program memory 26 depending on the evaluation of said scanning and interpretation circuit.

If a new form is represented on the display workstation 12, then the procedure described above is repeated, beginning with the input of a data word for form selection into the display memory 13 via the keyboard.

Fig. 2 shows the basic design of a further data processing system for explaining the control of form processing further. Said figure shows a scanning and interpretation unit 50 as a programmable execution controller, into which the data of a form to be processed can be loaded. The data of all forms that can be processed - referred to as form data in the text below - are stored in a form memory 51 as a set of forms as form specifications, and from there proceed via a first data path 52 into the scanning and interpretation unit 50 under the control of a data processing and control unit, not shown. The user selects the form to be processed by entering an appropriate control command with the keyboard 53 of his display workstation 54 via an external bus 56 in a form selection module 57, which in turn forms the storage address of the selected form specification and sends these together with a read command to the form memory 51 via a first control path 65.

Each form specification contains the coordinates

of the location of the form on the display 55 of the display workstation 54, as well as a sequential record of definitions of the fields making up the form. The field definitions are stored in the scanning and interpretation unit 50 in such a way that each field is assigned its own "compartment" 58. Said "compartments" are represented symbolically in Fig. 2. Each field definition contains a field name and the coordinates of the respective field within the form.

The scanning and interpretation unit 50 is connected via an internal bus 59 to a field type memory 60. The latter contains, inter alia, pointers to the field type processing modules 61 assigned to the individual field types. The scanning and interpretation unit 50 is connected to said modules, likewise via the internal bus 59. All field type processing modules 61 are furthermore interconnected with the external bus 56, via which they can access a database memory 62 and the display workstation 54.

In order to allow the user to create new forms or amend existing ones, the display workstation 54 is to be connected via the external bus 56 to a form specification module 63, which in turn can access the form memory 51 and the field type memory 60 via a second data path 64. The form specification module 63 addresses and controls the memories 51 and 60 via a second control path 66.

The operation of the circuit arrangement according to Fig. 2 will be described below with reference to Fig. 3. The latter shows parts of a delivery note as an example of a screen form. The form can fill a screen page 80, or else it can comprise any number of further screen pages 81, 82. The layout of the screen form or the distribution of the fields 83 preferably corresponds to that of the paper form, which can be printed out by a printer as the result of the work operation.

As already described, the user starts the processing operation by inputting a control command, here the command "delivery note", into the form selection module 57 with the keyboard 53. The form is represented

as a screen mask on the display 55, that is to say the field designations "Recipient", "Customer number", "Date", etc. are displayed on the screen, while the associated fields 83 are filled either by the user via the keyboard 53 or in the course of the processing of the form by the field type processing modules 61. The data required for representing the screen mask are supplied to the display 55 from the scanning and interpretation unit 50 via the internal bus 59, the form selection module 57 and also the external bus 56. If necessary, the user makes a further processing selection by means of a further control command (for example "create", "amend", "review"). In this example, the form selection module 57 initiates the loading of the form specification of the delivery note generation form from the form memory 51 into the scanning and interpretation unit 50 in such a way that one "compartment" 58 is occupied by each field 83.

When form processing commences, the contents of the first compartment 58 are made available for processing by the scanning and interpretation unit 50. For this, first of all the field type assigned to the field is determined from a field name directory stored in the field type memory 60. A field type processing module 61 is, as already mentioned, assigned to each field type.

Thus, for example, the "Delivery note no." and "Customer no." fields are so-called identification fields. The "Date" field is a field of the date type. The "Article no." field is termed an identification field with embedded identity, because further information such as article designation and price is assigned to the article number. The "Quantity" and "Price" fields are value fields, and the "Recipient" and "Designation" fields are text fields. Further field types are conceivable. As many field types, and hence field type processing modules 61, are realised as there are data types with associated processing routines in this system.

Thus, for example, the calendar date type is required because a calendar date is subjected to a

specific type of processing. The date entered must also be checked, for example to verify whether this day actually exists in the calendar.

5 A checksum calculation is performed in the identification fields. It must be possible to perform algebraic calculations in the value fields, etc.

10 Once the field type has then been determined, and hence the associated field type processing module 61 has been assigned, the field definition data are transferred thereto. The data required for processing the field are called up by the field type processing module 61 from the database 62 and processing results are stored there. The information to be displayed in the corresponding field 83 of the screen form is output to the display 55.

15 Once the field type processing module 61 has completed its work, it reports this via the internal bus 59 to the scanning and interpretation unit 50, which thereupon makes the contents of the next compartment 58 available. The latter is processed in the manner  
20 described above. These operations are repeated until all compartments 58 have been processed. It is not necessary for the screen form to be processed here in the order of the fields 83. Since, as described, the field definitions contain, inter alia, the coordinates of the respective  
25 field 83 within the form, every field can be arranged at any position on the form, even beyond the borders of the screen pages. The order of field processing, on the other hand, is determined only by the order of the field definition records in the scanning and interpretation  
30 unit 50.

Thus, in the example shown in Fig. 3, first the "Delivery note no." field, then the "Date" field and following that the "Customer no." field can be processed, despite the fact that the order shown in Fig. 3 on the  
35 screen is different.

Patent claims

1. Method of controlling program execution when processing forms in data processing systems for data contents of a form constructed from fields to be processed, in which the visual representation of the form, the reading and displaying of the data relevant for said form, the manipulation of said data by the user and the processing of said data is initiated by a form processing program permanently assigned to the form, in which data words are additionally assigned to a form specification as field specifications of the individual fields of the form, which data words are read and sequentially evaluated in connection with the form representation in order to address an individual program for each field in the order corresponding to said evaluation, and in which the individual programs addressed in this manner are successively processed, characterised in that a plurality of form specifications are provided in a form memory, in that a selected form specification is loaded field-by-field from the form memory into a scanning and interpretation unit, in that the form specification divided in this way is processed field-by-field in that the definition data of each field are compared with a name directory stored in a field type memory to determine the respective field type, and in that the definition data of each field are supplied to a field type processing module assigned to its field type, in that a field-typical processing of data is executed in communication with a field data memory in accordance with an individual program.

2. Method according to Claim 1, characterised in that the respective form specification is evaluated to identify field designations contained therein, and in that the individual programs are called up depending on the identification result.

3. Method according to Claim 1 or 2, characterised in that the order in which the individual programs are called up is also prescribed by the form specification.

4. Method according to Claim 2 or 3, characterised

in that the respective individual program is called up in accordance with the field type determined from the identification result.

5. Method according to Claim 4, characterised in  
5 that the identification result is used for accessing the stored data assigned to the respective identified field.

6. Method according to Claim 1, characterised in that the definition data are also used for the visual representation of the form mask.

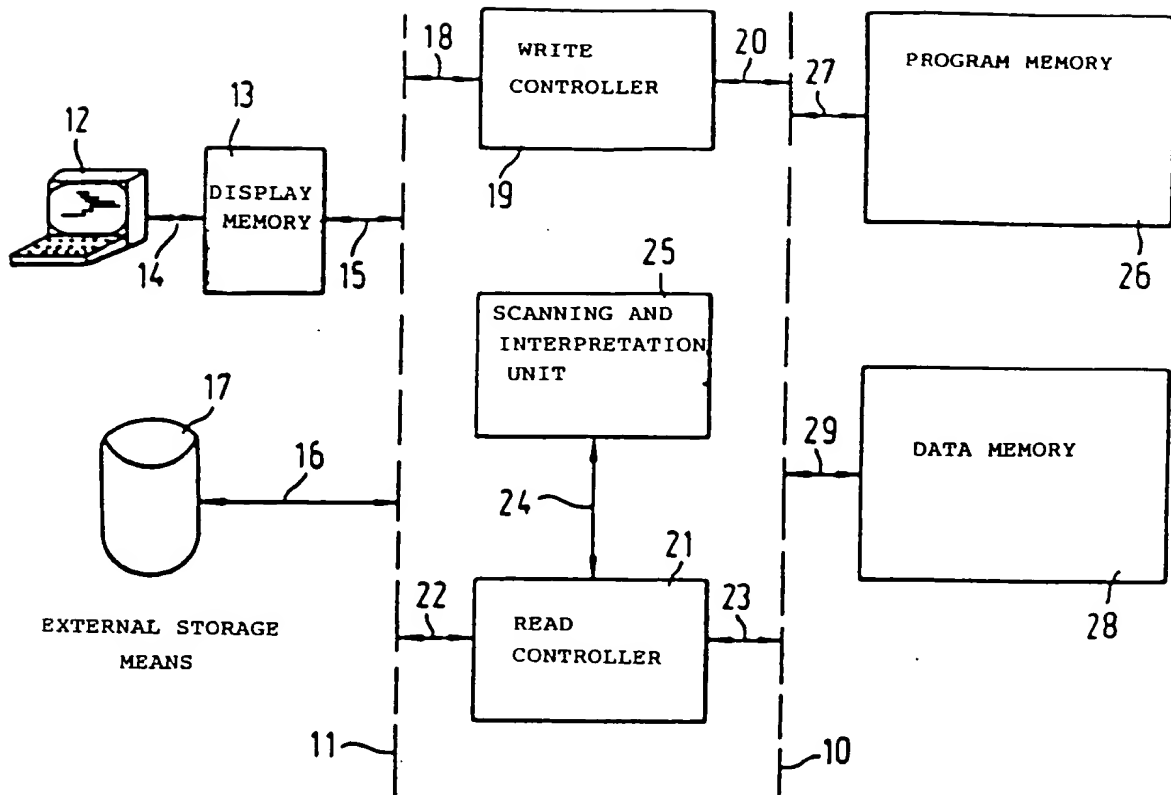


Fig. 1

Form for a **DELIVERY NOTE** (Fig. 3). The form is divided into several sections:

- Header:** **DELIVERY NOTE** (80).
- Recipient:** A box (83) for the recipient's name.
- Delivery note no.:** A box (83) for the delivery note number.
- Customer no.:** A box (83) for the customer number.
- Date:** A box (83) for the date.
- Ser. no.:** A box (83) for the serial number.
- Table:** A table with 5 columns: **Article no.**, **Designation**, **Quantity**, and **Price**. The first column is labeled **Ser. no.** and contains checkboxes.

Ser. no.	Article no.	Designation	Quantity	Price
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				

Fig. 3

